

Maintaining Corrosion Protection by Anticipating Increased Environment, Safety and Health Requirements

Patrick J. Taylor, P.E.
Hughes Associates, Inc.
9-11 February 2009

| Report Documentation Page | | | | Form Approved OMB No. 0704-0188 | |
|--|------------------------------------|-------------------------------------|---|---|---------------------------------|
| Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. | | | | | |
| 1. REPORT DATE FEB 2009 | | 2. REPORT TYPE | | 3. DATES COVERED 00-00-2009 to 00-00-2009 | |
| 4. TITLE AND SUBTITLE Maintaining Corrosion Protection by Anticipating Increased Environment, Safety and Health Requirements | | | | 5a. CONTRACT NUMBER | |
| | | | | 5b. GRANT NUMBER | |
| | | | | 5c. PROGRAM ELEMENT NUMBER | |
| 6. AUTHOR(S) | | | | 5d. PROJECT NUMBER | |
| | | | | 5e. TASK NUMBER | |
| | | | | 5f. WORK UNIT NUMBER | |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Hughes Associates, Inc,8010 Crabtree Place,Gaithersburg,MD,20879 | | | | 8. PERFORMING ORGANIZATION REPORT NUMBER | |
| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) | | | | 10. SPONSOR/MONITOR'S ACRONYM(S) | |
| | | | | 11. SPONSOR/MONITOR'S REPORT NUMBER(S) | |
| 12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited | | | | | |
| 13. SUPPLEMENTARY NOTES 2010 U.S. Army Corrosion Summit, Huntsville, AL, 9-11 Feb. U.S. Government or Federal Rights License | | | | | |
| 14. ABSTRACT | | | | | |
| 15. SUBJECT TERMS | | | | | |
| 16. SECURITY CLASSIFICATION OF: | | | 17. LIMITATION OF ABSTRACT Same as Report (SAR) | 18. NUMBER OF PAGES 18 | 19a. NAME OF RESPONSIBLE PERSON |
| a. REPORT unclassified | b. ABSTRACT unclassified | c. THIS PAGE unclassified | | | |

Three Questions

1. What do **Environment, Safety and Health (ESH)** requirements have to do with **Corrosion Prevention and Control (CPC)**?
2. How are ESH requirements increasing?
3. How is **RDECOM** responding?



ESH vs. CPC

- Often competing requirements
- Many CPC processes subject to Executive Orders, EPA/OSHA Regulations, DoD/Army policies, etc.
 - Plating, Finishing, Sealing, etc.
 - Painting, Depainting, Cleaning, etc.
- Many ingredients in CPC materials are ESH bad actors
 - Heavy metals, e.g., hex chrome, cadmium, cobalt
 - HAP/VOC solvents, e.g., methylene chloride (MeCl), trichlorethylene (TCE)
- RDECOM needs to offer suitable alternatives to ESH offenders before they are regulated out

DoD Policy: Minimizing the Use of Hexavalent Chromium

- USD(AT&L) memo 08 Apr 09 directing DoD to:
 - Invest in RDT&E for alternatives
 - Approve alternatives that meet requirements
 - Update technical documents to implement alternatives
 - Document system-specific risks in the PESHE
 - Require PEO and Service Corrosion Executive to certify that no acceptable alternatives exist for new systems
- Applies to all new program starts, new program increments and infrastructure-related procurements
 - Applies to legacy systems only when system mods and procedure updates allow for insertion of alternatives

DFARS Clause: Prohibition on Use of Hexavalent Chromium

- Policy to be implemented in Defense Federal Acquisition Regulation Supplement (DFARS)
 - Future defense contracts will prohibit hex chrome unless specifically approved by the government
- Draft rule distributed for review Aug 09
 - Unless otherwise exempt, clause must be included in all DoD solicitations and contracts for materials, parts, equipment, systems, subsystems and components
- As of 15 Jan 10, DFARS case still open

DLSME NESHAP

- EPA planning to propose National Emission Standards for Hazardous Air Pollutants (NESHAP) for surface coating of Defense Land Systems and Miscellaneous Equipment (DLSME)
 - Will apply to all DoD facilities and some OEMs (munitions)
- DoD provided data supporting the following limits
 - Numerical HAP limits on MILSPEC coatings
 - HAP-free solvents for substrate cleaning and paint thinning unless otherwise authorized by technical documents
 - HAP-free solvents or work practices for paint gun cleanup
 - Work practices, usage caps for MeCl depainting

DLSME NESHAP

Highest Use Coating Specs

| Spec Number | Title |
|--------------------|--|
| MMM-A-121 | Adhesive, Bonding Vulcanized Synthetic Rubber to Steel |
| A-A-1936 | Adhesives, Contact, Neoprene Rubber |
| MIL-C-81904 | Coating Compound, Thermal-Insulation, Ablative |
| MIL-C-46168 | Coating, Aliphatic Polyurethane, Chemical Agent Resistant |
| MIL-DTL-53039 | Coating, Aliphatic Polyurethane, Single Component, Chemical Agent Resistant |
| MIL-PRF-22750 | Coating, Epoxy, High-Solids |
| MIL-PRF-85285 | Coating, Polyurethane, Aircraft and Support Equipment |
| MIL-DTL-64159 | Coating, Water Dispersible Aliphatic Polyurethane, Chemical Agent Resistant |
| MIL-DTL-11195 | Enamel, Lusterless, Fast Dry, VOC Compliant (for Use on Ammunition and Other Metals) |
| MIL-E-52891 | Enamel, Lusterless, Zinc Phosphate, Styrenated Alkyd Type |
| TT-E-516 | Enamel, Lustreless, Quick-Drying Styrenated Alkyd Type |
| A-A-208 | Ink, Marking, Stencil, Opaque (Porous and Non-Porous Surfaces) |
| MIL-P-14105 | Paint, Heat-Resisting (for Steel Surfaces) |
| TT-P-2756 | Polyurethane Coating, Self-Priming Topcoat, Low VOC Content |
| TT-P-1757 | Primer Coating, Alkyd Base, One Component |
| MIL-PRF-23377 | Primer Coating, Epoxy, High Solids |
| MIL-P-53030 | Primer Coating, Epoxy, Water Reducible, Lead and Chromate Free |
| MIL-P-53022 | Primer, Epoxy Coating, Corrosion Inhibiting, Lead and Chromate Free |

Aerospace NESHAP

Residual Risk Assessment

- Promulgated 1995, effective 1998
- DoD has already spent \$ millions demonstrating compliance with standards that do not eliminate pollution
 - “Specialty coatings” with no requirements
 - “Parts normally removed” with unlimited use of MeCl
 - “Composite vapor pressure” limits on solvents
 - Most HAP solvents are low in vapor pressure
 - Xylene, ethylbenzene, MIBK, toluene all compliant
 - MEK/acetone mixture also compliant but actually has higher vapor pressure than pure MEK
- 10-year review currently underway
 - Aerospace NESHAP not expected to meet recent court rulings
 - Too many instances of “no control” MACT floors

Executive Order 13423 & Army Goals for Toxic Chemical Reduction

- EO 13423 required Federal agencies to set goals for reducing use of toxic chemicals
- DoD implemented by requiring Services to:
 - Identify three or more chemicals for reduction
 - Establish usage baselines
 - Set future reduction goals
- Army issued goals in Nov 09 to reduce the use of three chemicals by 2013
 - Hexavalent chromium
 - TCE
 - MeCl

Draft Toxicological Review of Trichloroethylene

- Findings expected to impact Halogenated Organic Solvent Cleaning NESHAP already in force
- History of TCE carcinogenicity data
 - 1995, International Agency for Research on Cancer: “probably carcinogenic to humans”
 - 2000, National Toxicology Program: “reasonably anticipated to be a human carcinogen”
 - 2001, Environmental Protection Agency: “highly likely” to be carcinogenic in humans
 - 2006, National Research Council: “potential human carcinogen”
 - 2009, Environmental Protection Agency:

“TCE is characterized as ‘Carcinogenic to Humans’ by all routes of exposure”

Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

- Candidate List updated Dec 09 with 15 new substances of very high concern, including:
 - Anthracene oils
 - Diisobutyl phthalate
 - Lead chromate compounds
 - tris(2-chloroethyl)phosphate
- Candidate List already included sodium dichromate among other CPC ingredients
- Substances on Candidate List may become subject to authorisation by decision of the European Commission
- REACH impacts on industry will filter down to DoD

Army Response to Increasing ESH Requirements

- Allocate funding to eliminate pollution while maintaining or improving corrosion protection
 - Base Army RDT&E
 - Leveraged OSD Corrosion Program
 - Leveraged SERDP, ESTCP, etc.
- Do not allocate funding to:
 - Hunt for loopholes
 - Justify inaction or non-compliance
 - Comply with bare minimum regulatory requirements
- Work with EPA/OSHA, not against them
 - DoD/Army get achievable standards at lower cost
 - EPA/OSHA get greater emission reductions

Army RDT&E Efforts Addressing ESH/CPC Requirements

- Sustainable Painting Operations for the Total Army program to eliminate HAPs in coatings
 - Materials developed and tested on lab-scale '03-'07
 - Materials demonstrated in real environments '08-'11
 - Materials approved and implemented throughout
 - Baseline HAP-containing materials phased out after implementation
- Toxic Metals Reduction program to reduce hex chrome and cadmium in surface finishing
 - Select efforts begun in '08
 - Full-scale program proposed in FY12-17 budget

Examples of ESH Technologies with Improved CPC Performance

- MIL-DTL-53039 Chemical Agent Resistant Coating
 - Two major changes made in Rev B (2005)
 - ESH: HAPs eliminated and VOCs reduced
 - CPC: Polymeric beads added to improve weathering resistance
 - Additional changes anticipated in 2010
 - ESH: Cobalt-based pigments being eliminated
 - CPC: New pigment being added to improve UV resistance
- MIL-DTL-53022 and -53030 Epoxy Primers
 - Two major changes anticipated in 2010
 - ESH: HAPs being eliminated and VOCs reduced
 - CPC: Improved performance in salt spray and cyclic tests

Select Products Already Implemented

TRL

9

- HAP-free, water-dispersible CARC topcoat, all types
 - MIL-DTL-64159 specification adopted 2002
 - Type III touch-up kits added 2007
- HAP-free, single component CARC topcoat, type II
 - MIL-DTL-53039 specification revised 2005
 - Type VIII touch-up kits added 2009
- HAP-free enamel for munitions, type II
 - MIL-DTL-11195 specification revised 2003
 - Supersession of TT-E-516 pending
- HAP-free degreasing solvent
 - MIL-PRF-680 specification revised 2006
- HAP-free anti-tamper sealant
 - Demonstrated 2008, NSNs assigned 2009
- Non-chromate epoxy primers, MIL-PRF-23377 class N and MIL-PRF-85582 class N
 - Developed by NAVAIR, approved by AMCOM 2008

8

7

6

5

4

3

2

1

Select Products to Look for 2010-11

- HAP-free CARC primers
 - MIL-P-53030 and MIL-P-53022 drafts in coordination
- CARC powder primers
 - New specification in coordination
- Cobalt-free CARC topcoats, all types
 - Green 383 pigment to be replaced by Green 808
 - All specs to be revised
- HAP-free cleaners for wipe, flush and immersion
 - Demonstrations complete, joint specification in development
- HAP-free immersion paint remover to replace MeCl
 - Two applications already demonstrated, others to follow
- HAP-free thinners for paints and adhesives
 - To be incorporated into existing specifications and SOPs
- Non-chromate trivalent chromium pretreatment (TCP)
 - Developed by NAVAIR, approval by AMCOM pending

TRL

9

8

7

6

5

4

3

2

1

Select Products to Look for 2012-13

- HAP-free system to replace TCE vapor degreasers
 - Demonstrations underway for two applications
- CARC powder topcoats
 - New specification to be developed
- HAP-free, non-skid coatings
 - To replace MIL-PRF-24667 and similar products
- HAP-free, high temperature coatings
 - To replace MIL-P-14105 and similar products
- HAP-free, general purpose adhesives
 - To replace MMM-A-121 and similar products
- Non-chromate wash primer
 - To replace DOD-P-15328 and similar products
- HAP-free munitions coatings
 - Numerous different specifications and applications

TRL

9

8

7

6

5

4

3

2

1

- Patrick J. Taylor, P.E.
Hughes Associates, Inc.
ptaylor@haifire.com
p.taylor@us.army.mil
410-737-8677 (office)